Metrology of Visibly Opaque, Infrared-Transparent Aerodynamic Domes, Conformal Windows, and Optical Corrector Elements

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The official link for this solicitation is:
http://www.acq.osd.mil/osbp/sbir/solicitations/sbir20152/index.shtml

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Description:

The function of electro-optical sensors is greatly impacted by the window’s properties. Survivability depends on material strength, hardness, and thermal properties. Targeting is limited by optical properties of the window material. Drag is reduced by aerodynamic shapes. The objective of this project is to create metrology methods and hardware to measure the optical figure and transmitted wavefront error of visibly opaque, infrared-transparent aerodynamic domes, conformal windows, and optical corrector elements to provide feedback for optical figure correction by an optics shop. Example materials include standard grade zinc sulfide (ZnS), hot pressed magnesium fluoride (MgF2), and germanium (Ge). Some materials of interest have negligible transparency below 2 microns and aspheric shapes made from these materials cannot be measured by any known method today. Possible candidate shapes include toroidal windows, tangent ogive domes, and arch shaped correctors. Methods capable of measuring objects whose two surfaces deviate more than 5 degrees from parallel could be useful. Potential metrology methods should have a precision of one tenth of the measurement wavelength, or better. PHASE I: Evaluate the feasibility of measuring the optical figure and transmitted wavefront of visibly opaque, infrared-transparent aerodynamic domes, conformal windows, and optical corrector elements with a precision of one tenth of the measurement wavelength, or better Demonstrate breadboard capability to measure freeform shapes such as a 5 inch diameter x 7 inch tall aerodynamic dome provided by the government. Measurement must

produce surface figure and transmitted wavefront maps with a precision of 0.5 micron or better. PHASE II: Improve the metrology technique and hardware developed in Phase I by increasing ease of use, precision of results, measurement speed, and adaptability to different shapes and sizes. The output of the method must be in a form that provides feedback to an optical polishing shop for figure correction. PHASE III: Implement commercial metrology capabilities. Manufacture an instrument for sale to optics manufacturers to measure visibly opaque aspheric optics. Alternatively, provide a commercial service to measure visibly opaque aspheric optics.